



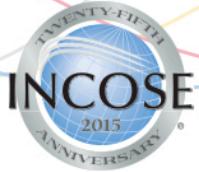
25th anniversary
annual INCOSE
international symposium
Seattle, WA
July 13 - 16, 2015



Systems Engineering Practices Exhibited in the Creation of a Film Original Score

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Apologies

Unfortunately I have not been able to be with you today...

....I am joining Virginia Tech in August as a junior faculty after 10+ year in the space industry...

....and the conference takes place right in between.

I hope to meet you in next IW and IS!



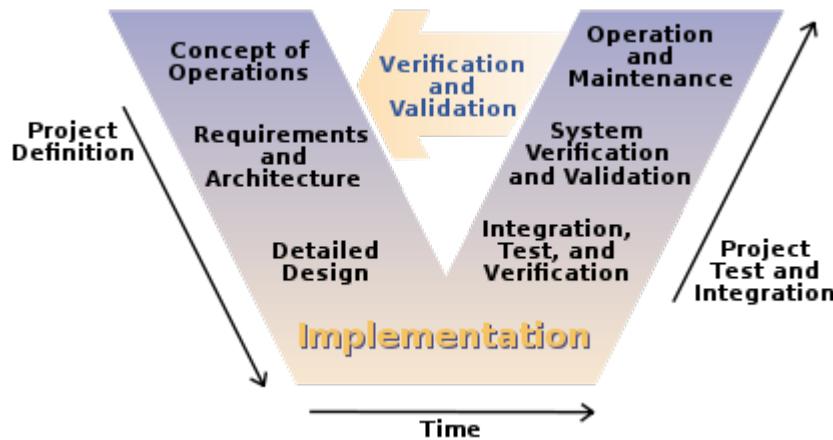
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Systems Engineering 101 class

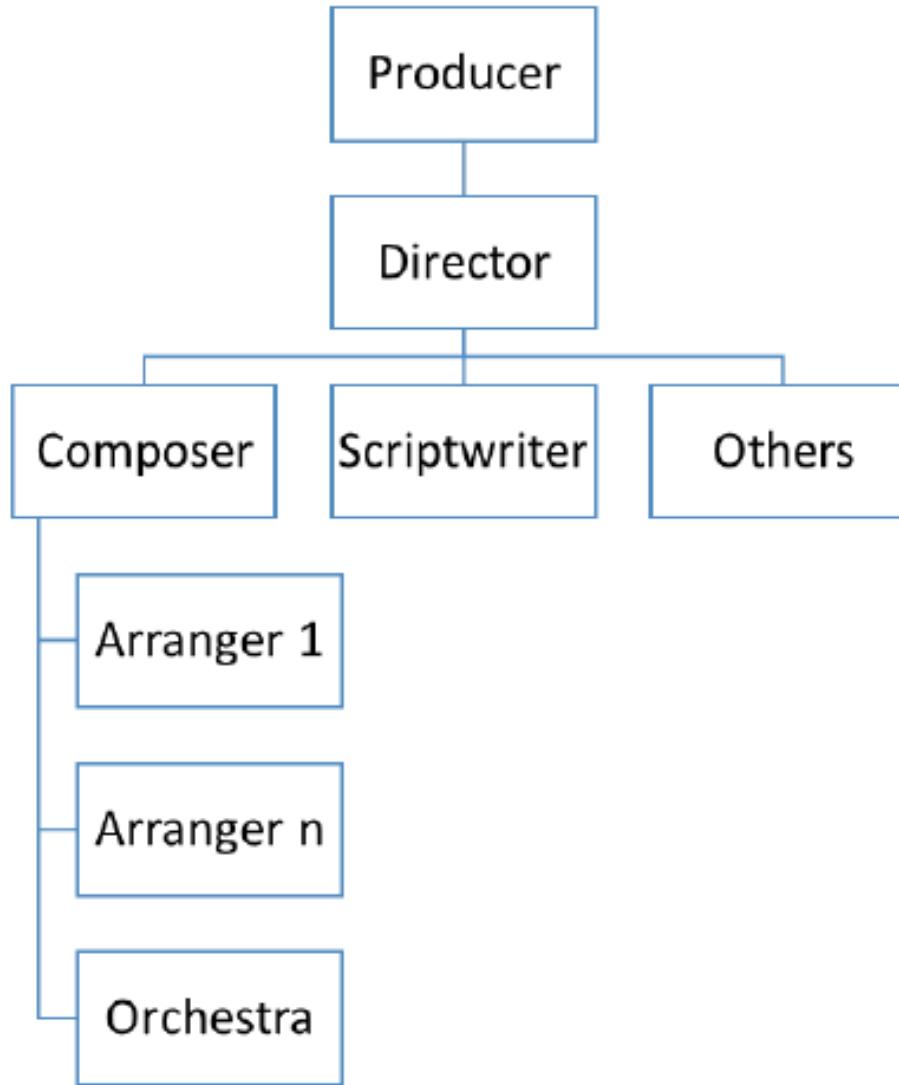
System of interest: *a film original score*



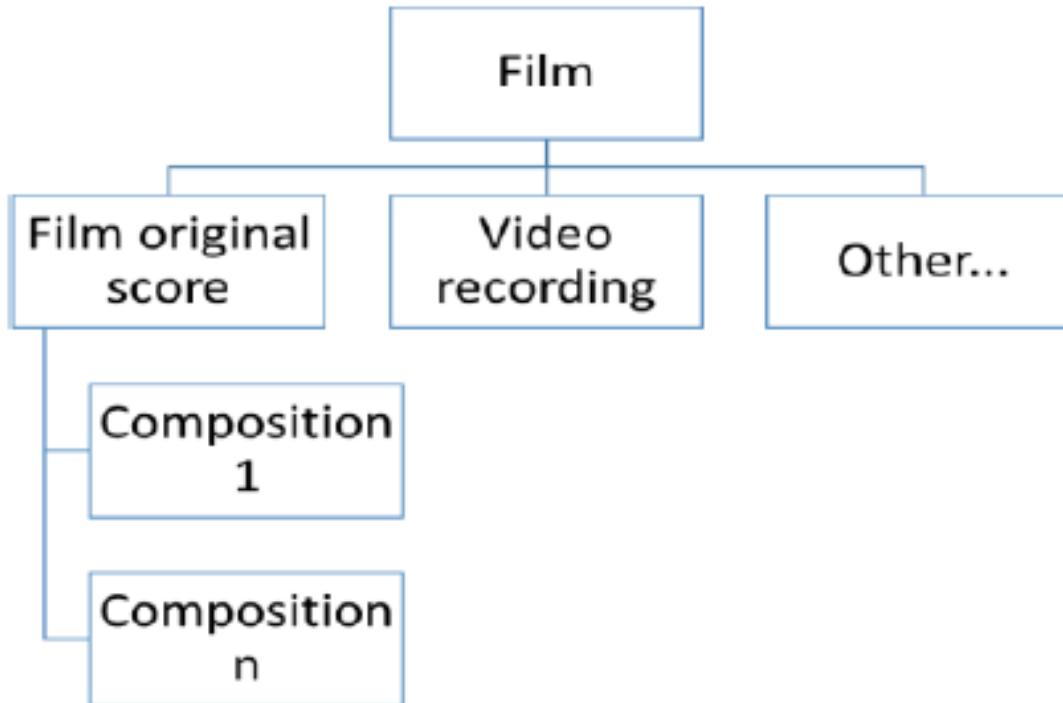
The V model image has been taken from Wikipedia The Free Encyclopedia

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Industrial organization



System decomposition



Stakeholder requirements (I)

Who: director and scriptwriter

Key needs: footage and dramatic structure

External interfaces:

- Duration and location of exposition
- Rising action, climax, falling action, resolution and epilogue

Composer's objective: understand all bits and pieces

Method: Eliciting requirements by multiple interview sessions with director and scriptwriter.

Artifacts:

- Technical script, provided by the director
- Narrative script, provided by the scriptwriter
- Notes taken by the composer

This is key for the composer, because the music needs to support the dramatic structure!

Stakeholder requirements (II)

Good practice:

The director NEVER dictates:

- Musical style
- Where to put the music
- How to do the music

The director ONLY dictates:

- What they want to transmit with their movie.

The composer assesses the interfaces to the film and interviews the director and the scriptwriter to understand their needs.

Failure to define design-independent needs often results in degraded performance.

ConOps / Concept alternatives

Who: composer

What: define how much music and where, together with thematic structure (film threads and sub-threads)

How: spotting session → Validation by the director and scripwriter

Good practices:

- Success is driven by a good thematic structure, choose it adequately and know how to place it.

Goodness:

- Effectiveness in transmitting the director's cinematographic discourse, not the beauty of the music

Music has not been composed at this stage yet!

Key: make sure the music concept can transmit the director's discourse

System requirements

Who: composer

What:

- Movie is split in blocks with unique identifiers
- Incorporate relevant information from stakeholder needs in each block, e.g. which actors (to which music threads may be assigned to) appear in each scene
- Tempo is set

How: cue sheets

Artifacts:

- Whiteboards, walls, composing software files.

Validation: Review by director in order to ensure the rhythm transmits their message

Music has not been composed at this stage yet!

Key: make sure the music characteristics can transmit the director's discourse

System architecture / Subsystem requirements



Who: composer

What:

- The whole film original score is composed in general terms.
 - A coherent underlying structure
 - Main leads are composed in order to ensure CONTINUITY of the music throughout the movie

How:

- Define music style (associated to a specific music color)
- Define the set of musical instruments that can be used and their priorities or roles
- Main leads, without secondary harmonies or arrangements.

Validation: Review by director in order to ensure the rhythm transmits their message

Actual music composing activities begin here!

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Detailed design

Who: arrangers

What:

- Full composition to each scene.

How:

- Under the constraints defined in HOWs of previous activity

Validation: The composer acts as an Equipment Supply Manager, i.e.:

- Evaluates fulfillment of requirements
- Manages and allocates financial and schedule budgets

Manufacturing & Integration

Who: arranger / orchestra

What:

- A demo → Prototype of each composition
- A master → Music to be directly incorporated to the film

How:

- Demo: using computer and digital with lower sound quality, done by arrangers
- Master: final music, recorded with “highest” sound quality.

Verification

Who: composer

What:

- With the demo: Ensures the music fits the directions defined by the composer
- With the master: Ensures the final product does not deviates from the accepted prototype

How:

- In this paper: subjective evaluation (minor productions)
 - 1) Check if elements of musical script (tempo, instrument set...) have been followed
 - 2) Check if aesthetics are of sufficient quality
- Future research: investigate if Hollywood (major productions) imposes any type of acceptance criteria in contractual conditions.

Validation (final)

Who: director / users – consumers of the movie

What:

- Demo: Ensure it transmits the director's technical discourse AND it fits the movie
- Master: Ensures the actual recording is “free of defects”

Conusmers:

- Like it... or not

Aesthetics

| Film original score (Engineered system) | | Musical standpoint | |
|--|--------------------------------|-----------------------|-----------------------------|
| Filmic standpoint | Ineffective (not compliant) | Ugly (Not elegant) | Beautiful (Elegant) |
| Filmic standpoint | Ineffective (not compliant) | Failure <i>End</i> | Failure <i>Reuse</i> |
| | Effective (compliant) | Success <i>End</i> | Success <i>Evolution</i> |

The effect of size

A **pop song** is composed differently

When these slides **were not applied** to a film original score:

- The film was more difficult to understand with music than without it
- The director's message was not conveyed when the music was played
- The music was unable to describe the internal psychology of the main character
- The music could not serve to anticipate unconsciously what was coming next
- Tiring effect on spectator due to constant change and lack of coherency
- After more than 1.5 years, it remained unfinished.

When they **were applied**:

- None of the above problems
- Finished in around 3 months

Future research

Can we apply SE methods to improve the way artistic products are developed?

Can we apply artistic methods to improve the way engineered products are developed?



Finale

In order to be fair with the presented, please
feel encouraged to send your questions to:

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Or

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